E C O N O M I C S   B U L L E T I N

Entry and exit under uncertainty in the presence of drift

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Abstract

Inserting the results of Kongsted (1996) in the analysis in Dixit (1989) shows that the negative effect of uncertainty on entry and exit is maximal in the absence of drift.

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1. Entry and Exit under Uncertainty in the Presence of Drift

Dixit (1989) has presented the case of a firm that has access to a certain production project. The output price, P, evolves exogenously over time according to:

$$dP = \mu Pdt + \sigma Pdz, \qquad (1)$$

where dz is the increment of a standard Wiener process, μ and σ are constants and $\sigma \geq 0$. Uncertainty exists if $\sigma > 0$ and a drift exists if $\mu \neq 0$. Entry and exit entail irreversible costs. The optimal policy is to enter the project when P exceeds a certain threshold level, denoted by P_H, and to exit the project when P falls below another threshold, denoted by P_L. The entry and exit thresholds in the stationary case of $\sigma = \mu = 0$ are denoted by w_H and w_L, respectively. Using a conservative set of parameter values Dixit has shown that P_H/w_H exceeds unity by more than 30% and that P_L/w_L is more than 20% below unity, implying that uncertainty has a strong negative effect on entry and exit.

Kongsted (1996) has returned to this model and studied the deterministic case in which $\sigma = 0$ but $\mu \neq 0$. Denoting the entry threshold of this case by M_H, he has found that when $\mu > 0$, i.e, in the presence of a positive drift, $M_H = w_H$ regardless of the specific value of μ. However, when $\mu < 0$, i.e., when a negative drift exists, M_H exceeds w_H and decreases in μ. Denoting the exit trigger in that case by M_L, he has found that $M_L = w_L$ when $\mu < 0$ regardless of the specific value of μ. When $\mu > 0$, M_L is below w_L and increases in μ.

Here, I follow Dixit's approach and use the ratios P_H/M_H and P_L/M_L to study how sensitive to the magnitude of the drift is the effect of uncertainty on investment. *Figure 1* below shows the results. The figure is based on the set of parameter values Dixit has used and is an adaptation of Dixit's *figure 4* to the case studied here.

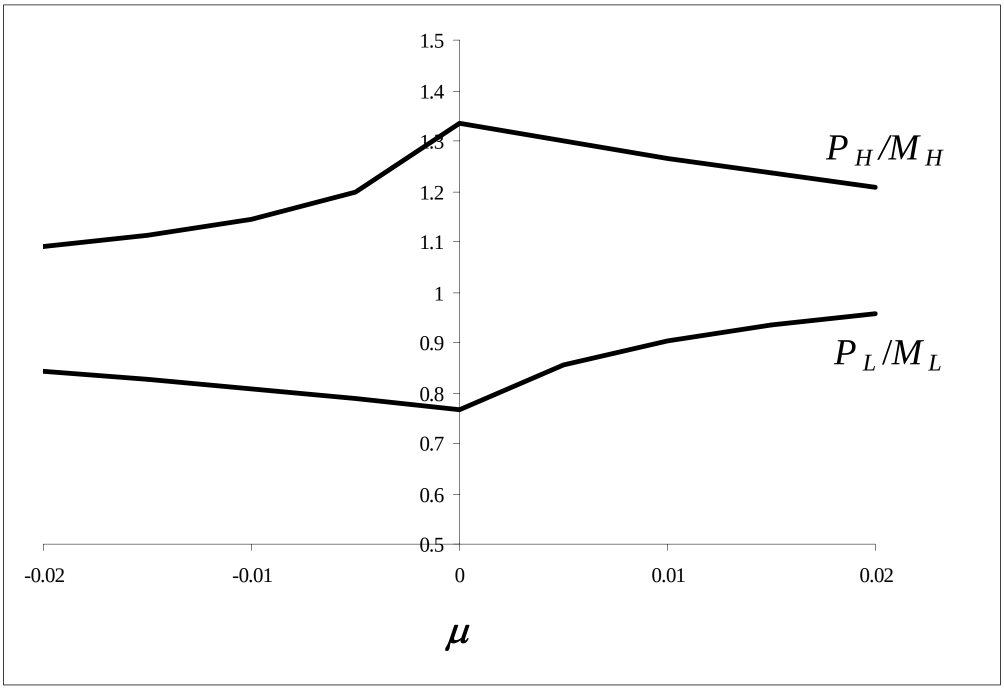

Figure 1: The ratios P_H/M_H and P_L/M_L. Parameter values taken from figure 4 in Dixit (1989). P_H and P_L were calculated from equations (12)-(15) in Dixit (1989). M_H when $\mu < 0$ and M_L when $\mu > 0$ were calculated from equations (2) and (3) in Kongsted (1996).

Since $P_H/M_H > 1$ and $P_L/M_L < 1$ for any μ, the figure shows that uncertainty has a negative effect on entry and exit. The figure also shows that this negative effect is maximal when neither positive nor negative drift exists.

The explanation for this result is that when μ>0 the positive drift weakens the negative effect of uncertainty on entry. Therefore, in that range P_H decreases in μ. Since in that range M_H is constant, P_H/M_H is decreasing in μ. When μ<0, both uncertainty and the negative drift affect entry negatively. While P_H reflects both effects, M_H is based merely on the drift effect. Therefore, as the absolute value of μ falls, M_H decreases more than P_H does and P_H/M_H increases. The same logic applies for P_L/M_L.

References

Dixit, Avinash. 1989. “Entry and Exit Decisions under Uncertainty”. *Journal of Political Economy* 97: 620-638.

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